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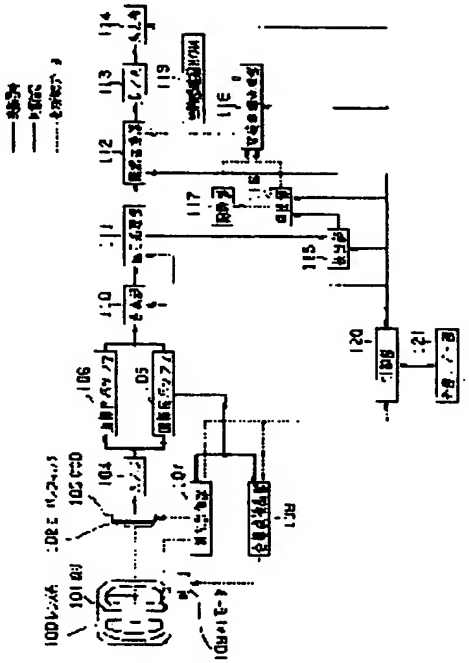
(54) ANIMATION IMAGING SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an animation imaging system which generates a high- definition image with respect to an optional photographic scene by properly switching a gradation conversion curve for converting the gradation width of the image obtained in time series at a low cost corresponding to scene change.
SOLUTION: A detection part 115 detects the presence and absence of scene change from a group of photographed images. When the scene change is detected, a calculation part 115 calculates the gradation conversion curve, and a recording part 117 records the calculated gradation conversion curve. A conversion curve composing part 118 composes the new gradation conversion curve calculated by the calculation part 115 and a past gradation conversion curve recorded by the recording part 117. A gradation conversion part 112 converts the gradation conversion characteristic of each image by using the composed gradation conversion curves. Thus, when switching a gradation curve corresponding to the scene change, unnatural feeling is reduced and the high-definition image can be obtained.



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CLAIMS

[Claim(s)]
[Claim 1] In the animation image pick-up system which changes and outputs the image group of the Mbit gradation width of face which continues serially from an image pick-up system to the Nbit gradation width of face (M and N are M>=N at the natural number) of an output system A detection means to detect scene change out of the above-mentioned image group, and a calculation means to compute a gray-scale-conversion curve from the image with which scene change was detected with the above-mentioned detection means, A conversion curvilinear composition means to compound the gray-scale-conversion curve of the past recorded on a record means to record the above-mentioned gray-scale-conversion curve, and the new gray-scale-conversion curve computed from the above-mentioned calculation means and the above-mentioned record means, The animation image pick-up system characterized by having a gray-scale-conversion means to change the image group of the above-mentioned Mbit gradation width of face into Nbit gradation width of face using the gray-scale-conversion curve compounded with the above-mentioned synthetic means.
[Claim 2] Furthermore, the animation image pick-up system according to claim 1 characterized by having an image composition means to compound the image of at least two or more frames picturized on different exposure conditions to the same photographic subject, or a field unit, and to generate the image group of the gradation width of face of Mbit.
[Claim 3] The above-mentioned detection means is an animation image pick-up system according to claim 1 or 2 characterized by having a time setting means to set up the time interval which chooses an image from the above-mentioned image group based on at least one of the image number of sheets photoed by per unit time amount from the above-mentioned image pick-up system, image size, exposure conditions, focus conditions, white balance conditions, a zoom location, and the camera locations.
[Claim 4] The above-mentioned detection means is the animation image pick-up system according to claim 3 carry out having a contraction means to reduce the image by which selection was made [above-mentioned] further to predetermined size, a brightness calculation means to compute an average intensity level from the image by which contraction was carried out [above-mentioned], and a decision means to judge the existence of scene change based on a serial change of the above-mentioned average intensity level as the description.
[Claim 5] The above-mentioned detection means is an animation image pick-up system according to claim 3 characterized by to have a contraction means reduce the image by which selection was made [above-mentioned] further to predetermined size, a motion vector calculation means compute the image lost-motion vector of two sheets which gets mixed up on the time series target of the image by which contraction was carried out [above-mentioned], and a decision means judge the existence of scene change based on the above-mentioned amount of motion vectors.
[Claim 6] The above-mentioned calculation means is the animation image pick-up system according to claim 1 or 2 carry out having a separation means divide the above-mentioned image into a luminance signal and a color-difference signal, an extract means extract a proper exposure region based on the above-mentioned luminance-signal level, a characteristic-quantity calculation means compute characteristic quantity about the above-mentioned proper exposure region, a histogram creation means create a histogram based on the above-mentioned characteristic quantity, and a gray-scale-conversion curvilinear calculation means compute a gray-scale-conversion curve based on the above-mentioned histogram as the description.
[Claim 7] A setting means to set two or more representation points as the new gray-scale-conversion curve by which the above-mentioned conversion curvilinear composition means was computed from the above-mentioned calculation means, and the gray-scale-conversion curve of the past recorded on the above-

mentioned record means, the representation point describing above -- receiving -- a predetermined weighting factor -- being based -- the above -- with a multiplication-addition means to compute a synthetic value from a new gray-scale-conversion curve and the gray-scale-conversion curve of the above-mentioned past The animation image pick-up system according to claim 1 or 2 characterized by having a interpolation means to interpolate between the representation points processed with the above-mentioned multiplication-addition means describing above.

[Claim 8] the above-mentioned conversion curvilinear composition means -- further -- the photography conditions from the above-mentioned image pick-up system -- being based -- the above from the gray-scale-conversion curve of the above-mentioned past -- the animation image pick-up system according to claim 7 characterized by having a transition-time setting means to define the transition time changed to a new gray-scale-conversion curve, and the weight control means which controls the above-mentioned weighting factor based on the transition time of the above-mentioned transition-time setting means.

[Claim 9] the gray-scale-conversion curve by which the above-mentioned conversion curvilinear composition means was further interpolated with the above-mentioned interpolation means, and the above -- the animation image pick-up system according to claim 7 characterized by having a change means to choose any one of the new gray-scale-conversion curves.

[Claim 10] the above-mentioned conversion curvilinear composition means -- further -- the representation point describing above -- being related -- the above -- the difference of a new gray-scale-conversion curve and the gray-scale-conversion curve of the above-mentioned past -- a calculus-of-finite-differences appearance means to compute a value, and the above -- difference -- the animation image pick-up system according to claim 7 characterized by having the adjustment device which adjusts the location or number of representation points based on a value.

[Claim 11] Furthermore, the animation image pick-up system according to claim 1 or 2 characterized by having a standard gray-scale-conversion curvilinear record means to record a standard gray-scale-conversion curve, an initialization detection means to detect initialization situations, such as a power up, and a transfer means to transmit the above-mentioned standard gray-scale-conversion curve to the above-mentioned gray-scale-conversion means based on the above-mentioned initialization detection means.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the animation image pick-up system which obtained the high definition output image by changing the gray-scale-conversion curve resulting from scene change appropriately with respect to an animation image pick-up system with the gradation width of face of the image pick-up system which obtains an image serially wider than the gradation width of face in an output system.
[0002]
[Description of the Prior Art] In the current digital camcorder, in order to prevent image degradation by the cancellation of significant digits of digital system signal processing, gradation width of face of the image in an input and a processor is more widely set up to the gradation width of face (usually 8 bits) of a final output image (about 10-12 bits). In this case, it is necessary to perform gray scale conversion so that it may agree to the gradation width of face of an output system.
[0003] Conventionally, it had changed with the application gray-scale-conversion curve based on a fixed gamma curve, a fixed histogram, etc. which were united with the standard scene.
[0004] Moreover, the technique of generating an extensive dynamic range image with more wide gradation width of face is proposed by compounding the image of two or more sheets with which light exposure differs. It is necessary to carry out gray scale conversion of the extensive dynamic range image obtained also in this case so that it may agree to the gradation width of face of an output system.
[0005] In order to be dependent on a photography scene, it is necessary to change such the gradation transfer characteristic appropriately based on scene change. However, change of the image which will be obtained if the gradation transfer characteristic is changed immediately after scene change produces sense of incongruity greatly. For this reason, for example by JP,11-164190,A, the approach of changing the gradation transfer characteristic gradually by carrying out the multiplication of the interpolation multiplier based on the time amount of an imitation rate is shown. Moreover, in JP,2000-307896,A, two or more gradation transfer characteristics are prepared, and in case this is chosen, the example which eases an abrupt change by performing hysteresis control is indicated.
[0006]
[Problem(s) to be Solved by the Invention] However, by the approach of changing the gradation transfer characteristic gradually by carrying out the multiplication of the interpolation multiplier, when changing the gradation transfer characteristic, the multiplication of the interpolation multiplier was carried out to the whole gray-scale-conversion curve. For this reason, the technical problem to which it is necessary to amend the number of data (1024-4096 points) for gradation width of face (10-12 bits) of an image on real time, and a hardware scale becomes large occurs. That is, it cannot respond to modification of the gradation transfer characteristic without sense of incongruity in low cost.
[0007] Moreover, the approach of preparing two or more gradation transfer characteristics, and performing hysteresis control at the time of selection does not have the guarantee in which the prepared gradation transfer characteristic suits a current scene. That is, it cannot respond to obtaining a high-definition image to the photography scene of arbitration.
[0008] This invention can change appropriately the gray-scale-conversion curve which changes the gradation width of face of the image obtained serially by low cost according to scene change paying attention to the above-mentioned trouble, and aims at offering the animation image pick-up system which can generate a high-definition image to the photography scene of arbitration.
[0009]

[Means for Solving the Problem] In the animation image pick-up system which the 1st invention changes into the Nbit gradation width of face (M and N are M>=N at the natural number) of an output system the image group of the Mbit gradation width of face which continues serially from an image pick-up system, and is outputted A detection means to detect scene change out of the above-mentioned image group, and a calculation means to compute a gray-scale-conversion curve from the image with which scene change was detected with the above-mentioned detection means, A conversion curvilinear composition means to compound the gray-scale-conversion curve of the past recorded on a record means to record the above-mentioned gray-scale-conversion curve, and the new gray-scale-conversion curve computed from the above-mentioned calculation means and the above-mentioned record means, It has a gray-scale-conversion means to change the image group of the above-mentioned Mbit gradation width of face into Nbit gradation width of face using the gray-scale-conversion curve compounded with the above-mentioned synthetic means. in addition, the detecting element 115 a detection means is indicated to be to drawing 1 -- a calculation means -- the calculation section 116 -- in the record means, as for a conversion curvilinear composition means, the conversion curvilinear composition section 118 corresponds, and, as for a gray-scale-conversion means, the gradation transducer 112 corresponds [the Records Department 117], respectively.

[0010] The desirable example of application of this 1st invention detects the existence of scene change from the image group photoed by the detecting element 115 shown in drawing 1 . When scene change is detected, a gray-scale-conversion curve is computed in the calculation section 115. The new gray-scale-conversion curve which recorded the computed gray-scale-conversion curve at the Records Department 117, and was computed in the calculation section 115, and the gray-scale-conversion curve of the past currently recorded at the Records Department 117 are compounded in the conversion curvilinear composition section 118. It is the animation image pick-up system which changes the gradation transfer characteristic of each image by the gradation transducer 112 using the compounded gray-scale-conversion curve.

[0011] In such the 1st invention, when scene change is detected, a new gray-scale-conversion curve is computed and the gradation transfer characteristic is changed using the past gray-scale-conversion curve and the compound gray-scale-conversion curve. Thereby, when changing a gray-scale-conversion curve corresponding to scene change, sense of incongruity is reduced and a high-definition image is obtained.

[0012] The 2nd invention has an image composition means to compound the image of at least two or more frames further picturized on different exposure conditions to the same photographic subject, or a field unit, and to generate the image group of the gradation width of face of Mbit, in the animation image pick-up system of the 1st invention. In addition, the synthetic section 110 an image composition means is indicated to be to drawing 1 corresponds.

[0013] The desirable example of application of this 2nd invention saves the image photoed with light exposure which is different by CCD103 shown in drawing 1 at the buffer 105 for images (for prolonged exposure images), and the buffer 106 for images (for short-time exposure images). The image of an extensive dynamic range is obtained by compounding these images in the synthetic section 110. When scene change is detected by the detecting element 115, a gray-scale-conversion curve is computed in the calculation section 116. The new gray-scale-conversion curve which recorded the computed gray-scale-conversion curve at the Records Department 117, and was computed in the calculation section 116, and the gray-scale-conversion curve of the past currently recorded at the Records Department 117 are compounded in the conversion curvilinear composition section 118. It is the image pick-up system which changes the gradation transfer characteristic of each image by the gradation transducer 110 using the compounded gray-scale-conversion curve.

[0014] In such the 2nd invention, when the image of different exposure is compounded, the image of the extensive dynamic range of one sheet is generated and scene change is detected to this image, a new gray-scale-conversion curve is computed and the gradation transfer characteristic is changed using the past gray-scale-conversion curve and the compound gray-scale-conversion curve. In order for this to perform gray scale conversion from the image more than the gradation width of face which can be treated by the image pick-up system, a more nearly high-definition image with few black crushing and white jumps is obtained. Moreover, when changing a gray-scale-conversion curve corresponding to scene change, sense of incongruity is reduced and a high-definition image is obtained.

[0015] The 3rd invention has a time setting means to set up the time interval which chooses an image from the above-mentioned image group based on at least one of the image number of sheets by which the above-mentioned detection means is photoed by per unit time amount from the above-mentioned image pick-up system, image size, exposure conditions, focus conditions, white balance conditions, a zoom location, and the camera locations, in the 1st or the animation image pick-up system of the 2nd invention. In addition,

time setting **** 200 a time setting means is indicated to be to drawing 2 corresponds.
[0016] the desirable example of application of this 3rd invention be an animation image pick-up system which adjust in application the time interval which choose an image in the time setting section 200 in the detecting element 115 which presume photography conditions based on the information from the photometry evaluation section 107 and the focusing point detecting element 108 which be show in drawing 1 , and the external I/F section 121 , and be show in drawing 2 .
[0017] In such the 3rd invention, the time interval which chooses an image according to photography conditions is changed automatically. Thereby, since an image is chosen to the timing according to a photography situation, the detectivity of scene change improves.
[0018] In the 4th invention, the above-mentioned detection means in the animation image pick-up system of the 3rd invention has a contraction means to reduce the image by which selection was made [above-mentioned] further to predetermined size, a brightness calculation means compute an average intensity level from the image by which contraction was carried out [above-mentioned], and a decision means judge the existence of scene change based on the serial change of the above-mentioned average intensity level. In addition, the decision section 206, as for a decision means, the brightness calculation section 204, as for a brightness calculation means, the contraction section 202 a contraction means is indicated to be to drawing 2 is indicated to be to drawing 2 is indicated to be to drawing 2 corresponds.
[0019] The desirable example of application of this 4th invention is an image pick-up system which detects scene change by reducing the image read from the signal-processing section 111 shown in drawing 1 in the image reading section 201 to predetermined size in the contraction section 202 in the detecting element 115 shown in drawing 2 , computing the average luminance value of an image in the brightness calculation section 204, and judging a brightness value change in the decision section 206.
[0020] In such the 4th invention, the selected image is reduced to predetermined size and scene change is detected from a serial change of the brightness value of this contraction image. In order for this to reduce the selected image, subsequent processings are mitigated, and the system of low cost can be realized. Moreover, since minute change of an image is absorbed in the phase to reduce, the image whose property of the gray-scale-conversion curve computed may be stable becomes legible. Furthermore, since it becomes detectable [scene change] from the whole image instead of a specific region, it becomes detectable [the scene change by the location of a photographic subject].
[0021] In the 5th invention, the above-mentioned detection means in the animation image pick-up system of the 3rd invention has a contraction means reduce the image by which selection was made [above-mentioned] further to predetermined size, a motion vector calculation means compute the image lost-motion vector of two sheets which gets mixed up on the time-series target of the image by which contraction was carried out [above-mentioned], and a decision means judge the existence of scene change based on the above-mentioned amount of motion vectors. In addition, the decision section 206, as for a decision means, the motion vector calculation section 210, as for a motion vector calculation means, the contraction section 202 a contraction means is indicated to be to drawing 3 is indicated to be to drawing 3 is indicated to be to drawing 3 corresponds.
[0022] The desirable example of application of this 5th invention is an animation image pick-up system which detects scene change and a main photographic subject location by reducing the image read from the signal-processing section 111 shown in drawing 1 in the image reading section 201 to predetermined size in the contraction section 202 in the detecting element 115 shown in drawing 3 , computing the motion vector in an image in the motion vector calculation section 210, and judging change of a motion vector in the decision section 206.
[0023] In such the 5th invention, the selected image is reduced to predetermined size, scene change is detected from a serial change of the motion vector of this contraction image, and it asks for a main photographic subject location based on the magnitude of a motion further. In order for this to reduce the selected image, subsequent processings are mitigated, and the system of low cost can be realized. Moreover, the gray scale conversion which put weight on main photographic subjects becomes possible, and a high-definition image is obtained.
[0024] The 6th invention the above-mentioned calculation means in the 1st or the animation image pick-up system of the 2nd invention A separation means to divide the above-mentioned image into a luminance signal and a color-difference signal, and an extract means to extract a proper exposure region based on the above-mentioned luminance-signal level, It has a characteristic quantity calculation means to compute characteristic quantity about the above-mentioned proper exposure region, a histogram creation means to create a histogram based on the above-mentioned characteristic quantity, and a gray-scale-conversion

curvilinear calculation means to compute a gray-scale-conversion curve based on the above-mentioned histogram. In addition, the gray-scale-conversion curvilinear calculation section 304, as for a gray-scale-conversion curvilinear calculation means, the histogram creation section 303, as for a histogram creation means, the edge extract section 302, as for a characteristic quantity calculation means, the proper exposure extract section 301, as for an extract means, the brightness separation section 300 a separation means is indicated to be to drawing 4 is indicated to be to drawing 4 is indicated to be to drawing 4 is indicated to be to drawing 4 is indicated to be to drawing 4 corresponds.

[0025] As opposed to the image transmitted from the detecting element 115 the desirable example of application of this 6th invention is indicated to be to drawing 1 A luminance signal is separated from an image in the brightness separation section 300 in the calculation section 116 shown in drawing 4 . Based on a luminance signal, extract a proper exposure region in the proper exposure extract section 301, and the edge component of a luminance signal is extracted in the edge extract section 302. It is the animation image pick-up system which computes the histogram of the edge section in the histogram creation section 303, and obtains a gray-scale-conversion curve from an accumulation histogram in the gray-scale-conversion curvilinear calculation section 304.

[0026] In such the 6th invention, an edge component is extracted from a luminance signal and a gray-scale-conversion curve is obtained from the accumulation histogram of the edge section. A high-definition image is obtained by computing the gray-scale-conversion curve which removed the flat background by this and put weight on main photographic subjects.

[0027] The 7th invention the above-mentioned conversion curvilinear composition means in the 1st or the animation image pick-up system of the 2nd invention A setting means to set two or more representation points as the new gray-scale-conversion curve computed from the above-mentioned calculation means, and the gray-scale-conversion curve of the past recorded on the above-mentioned record means, the representation point describing above -- receiving -- a predetermined weighting factor -- being based -- the above -- it has a multiplication-addition means to compute a synthetic value from a new gray-scale-conversion curve and the gray-scale-conversion curve of the above-mentioned past, and a interpolation means to interpolate between the representation points processed with the above-mentioned multiplication-addition means describing above. In addition, the interpolation section 408, as for a interpolation means, the multiplication-addition section 405, as for a multiplication-addition means, the representation point sampling section 402 a setting means is indicated to be to drawing 5 is indicated to be to drawing 5 is indicated to be to drawing 5 corresponds.

[0028] As opposed to two gray-scale-conversion curves incorporated with the gray-scale-conversion curvilinear buffers 400 and 401 from the calculation section 116 and the Records Department 117 by which the desirable example of application of this 7th invention is shown to drawing 1 It is the animation image pick-up system which generates a gray-scale-conversion curve by extracting the value in a predetermined representation point in the representation point sampling section 402 in the conversion curvilinear composition section 118 shown in drawing 5 , compounding the representation point of two gray-scale-conversion curves in the multiplication-addition section 405, and carrying out interpolation processing of between representation points in the interpolation section 408.

[0029] In such the 7th invention, several representation points are extracted from the new gray-scale-conversion curve computed after scene change, and the gray-scale-conversion curve of the past used before scene change, and the gray-scale-conversion curve which compounded both is generated. A gray-scale-conversion curve old and new in the small amount of operations can be compounded by this, and it becomes possible to realize a high speed and low cost processing.

[0030] the above-mentioned conversion curvilinear composition means [in / in the 8th invention / the animation image pick-up system of the 7th invention] -- further -- the photography conditions from the above-mentioned image pick-up system -- being based -- the above from the gray-scale-conversion curve of the above-mentioned past -- it has a transition-time setting means define the transition time changed to a new gray-scale-conversion curve, and the weight control means which controls the above-mentioned weighting factor based on the transition time of the above-mentioned transition-time setting means. In addition, the weight control section 407, as for a weight control means, the transition-time setting section 406 a transition-time setting means is indicated to be to drawing 5 is indicated to be to drawing 5 corresponds.

[0031] The desirable example of application of this 8th invention is an animation image pick-up system which sets up the transition time which changes an old and new gray-scale-conversion curve, and adjusts the weighting factor to an old and new gray-scale-conversion curve based on the transition time based on the

photography conditions transmitted from the control section 120 shown in drawing 1 by the weight control section 407 in the transition-time setting section 406 in the conversion curvilinear composition section 118 shown in drawing 5 .

[0032] In such the 8th invention, the transition time which changes an old and new gray-scale-conversion curve based on photography conditions is found, and a weighting factor is adjusted so that it may change from the past gray-scale-conversion curve to a new gray-scale-conversion curve within this time amount. Since a gray-scale-conversion curve changes by the transition time suitable for photography conditions by this, little change of sense of incongruity is attained.

[0033] the gray-scale-conversion curve by which the above-mentioned conversion curvilinear composition means [in / in the 9th invention / the animation image pick-up system of the 7th invention] was further interpolated with the above-mentioned interpolation means, and the above -- it has a change means to choose any one of the new gray-scale-conversion curves. In addition, the change section 409 a change means is indicated to be to drawing 5 corresponds.

[0034] The desirable example of application of this 9th invention is an animation image pick-up system which changes the new gray-scale-conversion curve transmitted from the gray-scale-conversion curve or the calculation section 116 compounded in the conversion curvilinear composition section 118 in the change section 409 from two gray-scale-conversion curves from the calculation section 116 and the Records Department 117 which are shown in drawing 1 .

[0035] In such the 9th invention, about the change of the gray-scale-conversion curve accompanying scene change, the inside of the predetermined transition time is the compounded gray-scale-conversion curve, and enables a change on a new gray-scale-conversion curve after that. Thereby, about the change of the gray-scale-conversion curve accompanying scene change, the processing section about composition can be bypassed after predetermined transition, and low-power-ization of it is attained.

[0036] the above-mentioned conversion curvilinear composition means [in / in the 10th invention / the animation image pick-up system of the 7th invention] -- further -- the representation point describing above -- being related -- the above -- the difference of a new gray-scale-conversion curve and the gray-scale-conversion curve of the above-mentioned past -- a calculus-of-finite-differences appearance means to compute a value, and the above -- difference -- it has the adjustment device which adjusts the location or number of representation points based on a value. in addition, the difference a calculus-of-finite-differences appearance means is indicated to be to drawing 5 -- the representation point controller 404, as for an adjustment device, the calculation section 403 is indicated to be to drawing 5 corresponds.

[0037] from the calculation section 116 the desirable example of application of this 10th invention is indicated to be to drawing 1 -- and two gray-scale-conversion curves from the Records Department 117 -- receiving -- difference -- the difference of both concerning a representation point at the calculation section 403 -- a value -- computing -- the representation point controller 404 -- difference -- it is the animation image pick-up system which adjusts a representation point based on a value.

[0038] the difference of a gray-scale-conversion curve old and new in such the 10th invention -- a value -- being based -- difference -- when a value is large, a representation point is adjusted to **, when densely small. Thereby, in order that the large gradation region of the difference between old and new gray-scale-conversion curves may arrange a representation point densely, a gray-scale-conversion curve with a more high precision can be compounded, and a high-definition image is obtained.

[0039] The 11th invention has further a standard gray-scale-conversion curvilinear record means to record a standard gray-scale-conversion curve, an initialization detection means to detect initialization situations, such as a power up, and a transfer means to transmit the above-mentioned standard gray-scale-conversion curve to the above-mentioned gray-scale-conversion means based on the above-mentioned initialization detection means, in the 1st or the animation image pick-up system of the 2nd invention. In addition, the change section 409, as for a transfer means, the control section 120, as for an initialization detection means, the standard gradation curve ROM 119 a standard gradation curvilinear record means is indicated to be to drawing 1 is indicated to be to drawing 1 is indicated to be to drawing 5 corresponds.

[0040] the desirable example of application of this 11th invention be an animation image pick-up system which read the gray scale conversion curve from which the change section 409 show in drawing 5 serve as a criterion recorded in the standard gradation curve ROM 119 , when a control section 120 judge an initialization situation and be judge to be an initialization situation based on the information from the photometry evaluation section 107 and the focusing point detecting element 108 which be show in drawing 1 , and the external I/F section 121 .

[0041] In such the 11th invention, when judged as an initialization situation, the gray-scale-conversion curve

used as the criterion currently recorded beforehand is read. Thereby, an image output is enabled also in the initialization situation that gray-scale-conversion curves, such as a power up, are not computed.
[0042]
[Embodiment of the Invention] The gestalt of implementation of invention is explained with reference to a drawing.
(Configuration) Drawing 1 is the animation image pick-up structure-of-a-system Fig. of the gestalt of 1 operation of this invention.
[0043] The image photoed through CCD103 of a lens system 100, diaphragm 101, a low pass filter 102, and a veneer type is changed into a digital signal in the A/D-conversion section 104. The signal from the A/D-conversion section 104 is transmitted to the synthetic section 110 through the buffer 105 for images (for long duration exposure images), and the buffer 106 for images (for short-time exposure images). The buffer 105 for images is connected also to the photometry evaluation section 107 and the focusing point detecting element 108. The photometry evaluation section 107 extracts and the focusing point detecting element 108 is connected to the AF motor 109 to 101 and CCD103. The signal from the synthetic section 110 is connected to the output sections 114, such as a monitor and a videocassette recorder, via the signal-processing section 111, the gradation transducer 112, and the D/A transducer 113.
[0044] Moreover, the signal-processing section 111 is connected to the calculation section 116 via the detecting element 115. The calculation section 116 is connected to the Records Department 117 and the conversion curvilinear composition section 118, and the Records Department 117 is also connected to the conversion curvilinear composition section 118. The conversion curvilinear composition section 118 is connected to the gradation transducer 112, and the standard gradation curve ROM 119 is connected to the conversion curvilinear composition section 118.
[0045] Moreover, the control sections 120, such as a microcomputer, are connected to the synthetic section 110, the signal-processing section 111, the gradation transducer 112, the output section 114, a detecting element 115, the calculation section 116, the conversion curvilinear composition section 118, and both directions.
[0046] Furthermore, the external I/F section 121 equipped with the interface for changing an electric power switch, a shutter release, and various modes at the time of photography is also bidirectionally connected to the control section 120. Moreover, the photometry evaluation section 107 and the focusing point detecting element 108 are also connected to the control section 120.
[0047] (Operation) The flow of a signal is explained in drawing 1 . Through the external I/F section 121, a user specifies photography conditions, such as image size and a frame number, and photography is started by pushing a shutter release after that. The video signal photoed through a lens system 100, diaphragm 101, a low pass filter 102, and CCD103 is changed into a digital signal in the A/D-conversion section 104, and is transmitted to the buffer 105 (long duration exposure image) for images. With the gestalt of this operation, gradation width of face of the digitized signal is set to 12 bits. The video signal in the buffer 105 for images is transmitted to the photometry evaluation section 107 and the focusing point detecting element 108.
[0048] It extracts [becoming proper exposure in quest of the intensity level in an image, and], and 101, the electronic shutter rate of CCD103, etc. are controlled by the photometry evaluation section 107. Moreover, by the focusing point detecting element 108, the edge reinforcement in an image is detected and a focus image is obtained by controlling the AF motor 109 so that this serves as max. The conditions at the time of photography of the exposure conditions searched for in the photometry evaluation section 107, the focus conditions searched for by the focusing point detecting element 108 are transmitted to a control section 120.
[0049] Next, the image of the 2nd sheet is photoed to the exposure conditions searched for in the photometry evaluation section 107 by the predetermined exposure ratio, for example, exposure conditions which are set to 1/8, and it is changed into a digital signal in the A/D-conversion section 104, and is transmitted to the buffer 106 (short-time exposure image) for images.
[0050] The synthetic section 110 reads the long duration exposure image on the buffer 105 for images, and the buffer 106 for images, and a short-time exposure image in order. First, it leaves the signal of the field below a predetermined threshold (for example, if it is 12-bit gradation 3890) as a proper exposure field about a long duration exposure image. Next, the short-time exposure image corresponding to fields other than a proper exposure field is read, and an exposure ratio is amended and compounded. With the gestalt of this operation, since it is set up so that it may be set to one eighth to long duration exposure, it will amend 8 times.
[0051] The signal after composition generates the signal of 3 tabular voice with which it was transmitted to the signal-processing section 111, and well-known interpolation processing, white balance processing,

emphasis processing, etc. were performed. The signal from the signal-processing section 111 is transmitted to a detecting element 115 at intervals of predetermined time based on control of a control section 120. A detecting element 115 detects the existence of scene change by comparing with the property of the image which computed predetermined property information and was chosen from the transmitted image last time. This result is transmitted to a control section 120.

[0052] A control section 120 controls the calculation section 116, when scene change is detected, and it makes a new gray-scale-conversion curve compute.

[0053] The calculation section 116 reads the image with which scene change was detected from a detecting element 115, computes a gray-scale-conversion curve based on a histogram, and transmits it to the Records Department 117 and the conversion curvilinear composition section 118. The Records Department 117 will be overwritten, if the gray-scale-conversion curve for one is recorded and the gray-scale-conversion curve from the calculation section 116 is transmitted. The conversion curvilinear composition section 118 transmits the gray-scale-conversion curve compounded from the old and new gray-scale-conversion curve based on control of a control section 120, the new gray-scale-conversion curve from the calculation section 116, or the gray-scale-conversion curve used as the criterion from the standard gradation curve ROM 119 to the gradation transducer 112.

[0054] The gradation transducer 112 is changed so that the signal from the signal-processing section 111 may be adjusted to the gradation width of face of an output system based on the gray-scale-conversion curve transmitted from the conversion curvilinear composition section 118. With the gestalt of this operation, gradation width of face of an output system is set to 8 bits. Then, it is changed into an analog signal by the D/A transducer 113, and is outputted to the output sections 114, such as a monitor and a videocassette recorder.

[0055] Drawing 2 shows an example of the configuration of a detecting element 115 which detects scene change from brightness, and serves as the time setting section 200, the image reading section 201, the contraction section 202, the buffer 203 for contraction images, the brightness calculation section 204, and the buffer 205 for brightness values from the decision section 206. The control section 120 is connected to the time setting section 200, the image reading section 201, the brightness calculation section 204, the decision section 206, and both directions. The time setting section 200 is connected to the image reading section 201. The signal from the signal-processing section 111 is connected to the calculation section 116 through the image reading section 201, the contraction section 202, and the buffer 203 for contraction images.

[0056] The signal from the buffer 203 for contraction images is connected to the decision section 206 via the brightness calculation section 204 and the buffer 205 for brightness values. From a control section 120, the information from the photometry evaluation section 107, the focusing point detecting element 108, and the external I/F section 121 is transmitted to the time setting section 200.

[0057] In the time setting section 200, information acquired from the external I/F section 121, such as image size and a frame number, is acquired from a control section 120, and the time interval which chooses the image from the signal-processing section 111 based on such information is determined. It is made for the burden to a latter processor not to increase this control by lengthening a time interval as for example, image size or a frame number becomes large. Moreover, when the photometry from the photometry evaluation section 107 and the focusing point detecting element 108 and focus conditions change suddenly, the time setting section 200 judges that scene change arose, sets a time interval as 0, and controls it to make an image read immediately. It is also possible to use information, such as a white balance, a zoom location of a lens, and migration of a camera, and to detect scene change besides this.

[0058] The image reading section 201 reads the signal from the signal-processing section 111 with a predetermined time interval based on the control from the time setting section 200, and transmits it to the contraction section 202. The contraction section 202 carries out contraction processing of the image with the reduction percentage defined beforehand, for example, 1 / 8 grades, and transmits it to the buffer 203 for contraction images. It is not necessary to make this reduction percentage immobilization, and it may be made adjustable. For example, it is also possible to control reduction percentage so that the amount of information within unit time amount is calculated from contraction image size and the time interval to choose and this amount of information becomes below constant value. The buffer 203 for contraction images is a ring-like buffer which can record the contraction image of two or more sheets, and if a buffer fills, it has composition overwritten from an old image. The contraction image in the buffer 203 for contraction images is transmitted to the calculation section 116.

[0059] On the other hand, the brightness calculation section 204 captures a contraction image from the

buffer 203 for contraction images based on control of a control section 120, and computes the average luminance value of a contraction image. This brightness value is transmitted to the buffer 205 for brightness values, and is saved. The buffer 205 for brightness values is a ring-like buffer which can record a brightness value, and if a buffer fills, it has composition overwritten from an old brightness value.

[0060] It is judged that scene change produced the decision section 206 when a serial change of a brightness value was supervised from the buffer 205 for brightness values, the change beyond a predetermined threshold occurred and the situation carried out count continuation of predetermined. This decision result is transmitted to a control section 120. Scene change does not need to be limited to the above-mentioned brightness value.

[0061] For example, drawing 3 shows the example of a configuration of the detecting element 115 which detects scene change from a motion vector, and serves as the time setting section 200, the image reading section 201 and the contraction section 202, the buffer 203 for contraction images, the motion vector calculation section 210, and the buffer 211 for motion vectors from the decision section 206. The control section 120 is connected to the time setting section 200, the image reading section 201, the motion vector calculation section 210, the decision section 206, and both directions. The time setting section 200 is connected to the image reading section 201. The signal from the signal-processing section 111 is connected to the calculation section 116 through the image reading section 201, the contraction section 202, and the buffer 203 for contraction images.

[0062] The signal from the buffer 203 for contraction images is connected to the decision section 206 via the motion vector calculation section 210 and the buffer 211 for motion vectors. The motion vector calculation section 210 reads the contraction image which gets mixed up serially from the buffer 203 for contraction images, divides an image into a predetermined block and performs well-known motion detection based on matching. Thereby, a motion vector is detected for every block and this result is transmitted to the buffer 211 for motion vectors.

[0063] It is judged that scene change produced the decision section 206 when the buffer 211 lost-motion vector information for motion vectors was read and the motion vector beyond a predetermined value was detected by the block more than a predetermined number. This decision result is transmitted to a control section 120.

[0064] Moreover, in case a gray-scale-conversion curve is computed based on a histogram in the calculation section 116, processing of giving gradation width of face to the field by carrying out the multiplication of the weighting factor to the field corresponding to the block with which the motion vector was detected is also possible.

[0065] Drawing 4 shows an example of the configuration of the calculation section 116 which computes a gray-scale-conversion curve, and consists of the brightness separation section 300, the proper exposure extract section 301, the edge extract section 302, the histogram creation section 303, and the conversion curvilinear calculation section 304. The control section 120 is connected to the brightness separation section 300, the proper exposure extract section 301, the conversion curvilinear calculation section 304, and both directions. A detecting element 115 is connected to the brightness separation section 300, and the brightness separation section 300 is connected to the proper exposure extract section 301 and the histogram creation section 303. The proper exposure extract section 301 is connected to the edge extract section 302 and the histogram creation section 303, and the edge extract section 302 is connected to the histogram creation section 303. The histogram creation section 303 is connected to the Records Department 117 and the conversion curvilinear composition section 118 through the conversion curvilinear calculation section 304.

[0066] When scene change is detected by the detecting element 115, a control section 120 controls the brightness separation section 300, and makes the above-mentioned contraction image capture from a detecting element 115. The brightness separation section 300 computes brightness from a contraction image. A luminance signal is compared with the predetermined threshold (if it is for example, 12-bit gradation, an umbra is 128 and a bright section is 3968) about an umbra and a bright section by the proper exposure extract section 301, and the luminance signal below the threshold of a bright section is transmitted to the edge extract section 302 and the histogram creation section 303 as a proper field above the threshold of an umbra.

[0067] The edge extract section 302 performs well-known edge detection, extracts the pixel which has the edge reinforcement beyond a predetermined threshold as the edge section, and transmits this information to the histogram creation section 303. The histogram creation section 303 creates the histogram of the edge section based on the information on the above-mentioned proper exposure region, and the information on the edge section from the luminance signal of the proper exposure region from the brightness separation

section 300.
[0068] The conversion curvilinear calculation section 304 is transmitted to the conversion curvilinear composition section 118 in quest of a gray-scale-conversion curve by accumulating the above-mentioned histogram. Moreover, based on control of a control section 120, a gray-scale-conversion curve is transmitted also to the Records Department 117. The Records Department 117 will be overwritten, when the gray-scale-conversion curve for one is recorded and a gray-scale-conversion curve is transmitted from the calculation section 116.
[0069] that drawing 5 indicates an example of the configuration of the conversion curvilinear composition section 118 to be -- it is -- the gray-scale-conversion curvilinear buffer 400, the gray-scale-conversion curvilinear buffer 401, the representation point sampling section 402, and difference -- it consists of the calculation section 403, the representation point controller 404, the multiplication-addition section 405, the transition-time setting section 406, the weight control section 407, the interpolation section 408, and the change section 409. The control section 120 is connected to the representation point sampling section 402, the representation point controller 404, the multiplication-addition section 405, the transition-time setting section 406, the change section 409, and both directions. The calculation section 116 is connected to the gray-scale-conversion curvilinear buffer 400, and the Records Department 117 is connected to the gray-scale-conversion curvilinear buffer 401. The gray-scale-conversion curvilinear buffer 400 and the gray-scale-conversion curvilinear buffer 401 are connected to the gradation transducer 112 through the representation point sampling section 402, the multiplication-addition section 405, the interpolation section 408, and the change section 409.
[0070] the representation point sampling section 402 -- difference -- it has connected with the representation point controller 404 through the calculation section 403, and the representation point controller 404 is connected to the representation point sampling section 402. The transition-time setting section 406 is connected to the multiplication-addition section 405 through the weight control section 407. The standard gradation curve ROM 119 and the calculation section 116 are connected to the change section 409. The gray-scale-conversion curve from the calculation section 116 is transmitted to the gray-scale-conversion curvilinear buffer 400, the gray-scale-conversion curve from the Records Department 117 is transmitted to the gray-scale-conversion curvilinear buffer 401, and it is saved.
[0071] the value corresponding to the gradation value to which the representation point sampling section 402 is set at predetermined spacing, for example, regular intervals, from both gray-scale-conversion curve based on control of a control section 120 -- as a representation point -- extracting -- this -- difference -- it transmits to the calculation section 403. difference -- the absolute value between the representation points that the calculation section 403 corresponds with both gray-scale-conversion curve -- computing -- this -- difference -- it considers as a value and transmits to the representation point controller 404. the representation point controller 404 -- the above -- difference -- when a value is beyond a predetermined threshold, a new representation point is added in the center between the representation points which adjoin the representation point. on the other hand -- the above -- difference -- when a value is below a predetermined threshold, the representation point is deleted. In addition, these additions and deletion do not have a limping gait crack to the starting point and the terminal point of a gray-scale-conversion curve.
[0072] drawing 6 -- difference -- adjustment of the representation point based on a value is shown. drawing 6 (a) -- like -- etc. -- the difference between the old and new gray-scale-conversion curves which the representation point set as spacing shows in this drawing (a) -- based on a value, it is shown in drawing 6 (b) -- as -- difference -- the section where a value is large, i.e., the section where gray scale conversion is steep, -- dense -- difference -- the section where a value is small, i.e., the section where gray scale conversion is loose, is adjusted to **.
[0073] The representation point controller 404 will be notified to a control section 120, if the above-mentioned tuning is completed. A control section 120 makes the value corresponding to the representation point adjusted to the representation point sampling section 402 extract, and is controlled to transmit this to the multiplication-addition section 405. Moreover, a control section 120 transmits information acquired from the external I/F section 121, such as image size and a frame number, to the transition-time setting section 406. The transition-time setting section 406 adjusts the transition time which changes an old and new gray-scale-conversion curve based on such information. the case where this is processing the image with them -- 2 - 3 seconds -- long -- a frame rate and image size -- small -- low -- when the dignified image is being processed, it shortens with about 1 second. [a frame rate, large image size, and] [highly defined] The set-up transition time asks for the image number of sheets N (sheet) generated in the transition time in the weight control section 408 from the set-up transition time T (second) and the current frame rate (a frame

number/second) F.
[0074]
N=TF (1)
The base unit of a weighting factor is given by 1-/N. The base unit of this weighting factor is transmitted to the multiplication-addition section 405.
[0075] In the multiplication-addition section 405, when the representation point of Vnew and the gray-scale-conversion curve of the past from the Records Department 117 is set to Vold for the representation point of the new gray-scale-conversion curve from the calculation section 116, the representation point V of the gray-scale-conversion curve compounded by following (2) is computed.
[0076]
V=i/N Vnew+(1-i/N) Vold (i= 0 - N) (2)
Here, i will be added every [1], whenever all the representation points of the gray-scale-conversion curve which is the counted value of the image number of sheets generated in the transition time, and was compounded based on (2) types can be found. The multiplication-addition section 405 transmits the compounded representation point to the interpolation section 408. The interpolation section 408 generates the value between representation points by well-known linear interpolation, and transmits it to the change section 409 as a compounded gray-scale-conversion curve.
[0077] Drawing 7 shows composition of the above-mentioned gray-scale-conversion curve. The compounded gray-scale-conversion curve which shifts to the new gray-scale-conversion curve shown in drawing 7 (e) from the gray-scale-conversion curve of the past shown in drawing 7 (a) gradually is shown. Several representation points [refer to drawing 6 (b)] are extracted from the past gray-scale-conversion curve, and sequential shift is carried out, performing polygonal-line approximation, as shown in drawing 7 (b) - (d). Like drawing 7 , an in-between gray-scale-conversion curve is computable by low cost carrying out polygonal-line approximation.
[0078] Based on control of a control section 120, the change section 409 transmits the gray-scale-conversion curve from the calculation section 116 for the gray-scale-conversion curve from the multiplication-addition section 405 to the gradation transducer 112 in the transition time which the transition-time setting section 406 defined except it, when scene change is detected. In addition, when a control section 120 detects initialization situations, such as a power up, the change section 409 transmits a gray-scale-conversion curve to the gradation transducer 112 from the standard gradation curve ROM 119 based on control of a control section 120.
[0079] When the transition time is completed and a change is completed to a new gray-scale-conversion curve, a control section 120 makes the gray-scale-conversion curve from the calculation section 116 transmit to the Records Department 117, and is made to record. in addition -- the above -- spacing of a representation point -- difference -- although adjusted based on the value, it is also possible to omit this when the fall of some precision is admitted. in this case, difference -- the calculation section 403 and the representation point controller 404 can be deleted, and a low cost configuration is attained. Moreover, the interpolation between the representation points in the interpolation section 408 does not need to be limited to linear interpolation, and can use the interpolation approach of arbitration.
[0080] Drawing 8 shows an example of the configuration of the gradation transducer 112, and consists of the Y/C separation section 500, the luminance-signal buffer 501, the color-difference-signal buffer 502, the brightness amendment section 503, the amendment luminance-signal buffer 504, the color difference amendment section 505, and the Y/C composition section 506. The control section 120 is connected to the Y/C separation section 500, the brightness amendment section 503, the color difference amendment section 505, the Y/C composition section 506, and both directions. The signal-processing section 111 is connected to the Y/C separation section 500, and the Y/C separation section 500 is connected to the luminance-signal buffer 501 and the color-difference-signal buffer 502. The brightness amendment section 503 is connected to the brightness amendment section 503 and the color difference amendment section 505 for the luminance-signal buffer 501 through the amendment luminance-signal buffer 504 to the Y/C composition section 506. Moreover, the conversion curvilinear composition section 118 is connected to the brightness amendment section 503. The color-difference-signal buffer 502 is connected to the Y/C composition section 506 through the color difference amendment section 505. The amendment luminance-signal buffer 504 is connected to the color difference amendment section 505, and the Y/C composition section 506 is connected to the D/A transducer 113.
[0081] It separates into a luminance signal and a color-difference signal in the Y/C separation section 500, and the signal from the signal-processing section 111 is saved respectively at the luminance-signal buffer

501 and the color-difference-signal buffer 502. The luminance signal of the luminance-signal buffer 501 is transmitted to the brightness amendment section 503, and is changed into 8 bits with the gradation width of face of an output system, and the gestalt of this operation with a predetermined gray-scale-conversion curve. The gray-scale-conversion curve used in the brightness amendment section 503 is read from the conversion curvilinear composition section 118 based on control of a control section 120. The luminance signal by which gray scale conversion was carried out in the brightness amendment section 503 is transmitted to the amendment luminance-signal buffer 504.

[0082] Next, the color difference amendment section 505 reads the color-difference signal on the color-difference-signal buffer 502, and receives the luminance signal before the gray scale conversion from the luminance-signal buffer 501, and the luminance signal after the gray scale conversion from the amendment luminance-signal buffer 504. The correction factor which amends the theoretical marginal model with which a color may exist to the luminance signal before and behind this conversion and a color-difference signal is computed, and a color-difference signal is amended. The amended color-difference signal is transmitted to the Y/C composition section 506, is compounded with the luminance signal after conversion from the amendment luminance-signal buffer 504, and is transmitted to the D/A transducer 113.

[0083] By the above-mentioned configuration, it becomes possible to carry out adjustable [of the change of the gray-scale-conversion curve corresponding to scene change] continuously within the transition time according to photography conditions, such as image size and a frame number, to the image of the arbitration picturized serially, and a high-definition image with little sense of incongruity is obtained. Moreover, since the image to process is reduced and the gray-scale-conversion curve within the transition time is computed from several representation points, computational complexity can be reduced and a low cost processor can be realized. Moreover, the image obtained since minute change of an image is absorbed by contraction processing is stabilized. Moreover, correspondence also of an initialization situation is attained by preparing a standard gradation curve.

[0084] In addition, although the extensive dynamic range image of one sheet was compounded with the above-mentioned configuration from the image of two sheets photoed with different light exposure (long duration, short-time exposure) to the same photographic subject, it does not need to be limited to such a configuration. It is applicable also to the system of the usual one-sheet photography. In the case of this one-sheet photography system, the buffer 106 for images and the synthetic section 110 are omissible.

[0085]

[Effect of the Invention] As stated above, according to this invention, to compensate for scene change, the animation image pick-up system which can be changed is [the gray-scale-conversion curve which changes the gradation width of face of the image obtained serially] appropriately realizable by low cost. Moreover, the animation image pick-up system which generates a high-definition image to the photography scene of arbitration is realizable.

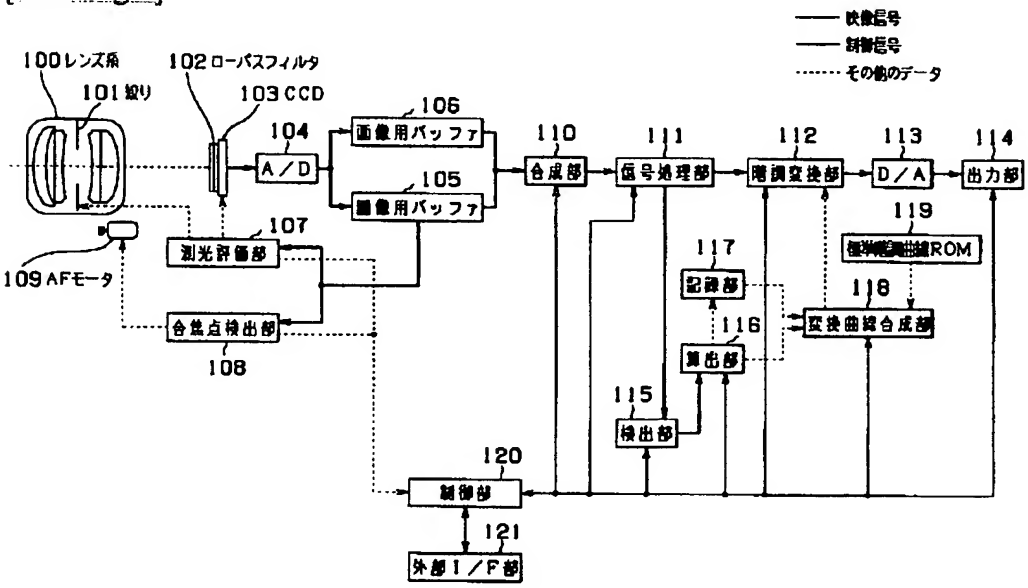
[Translation done.]

* NOTICES *

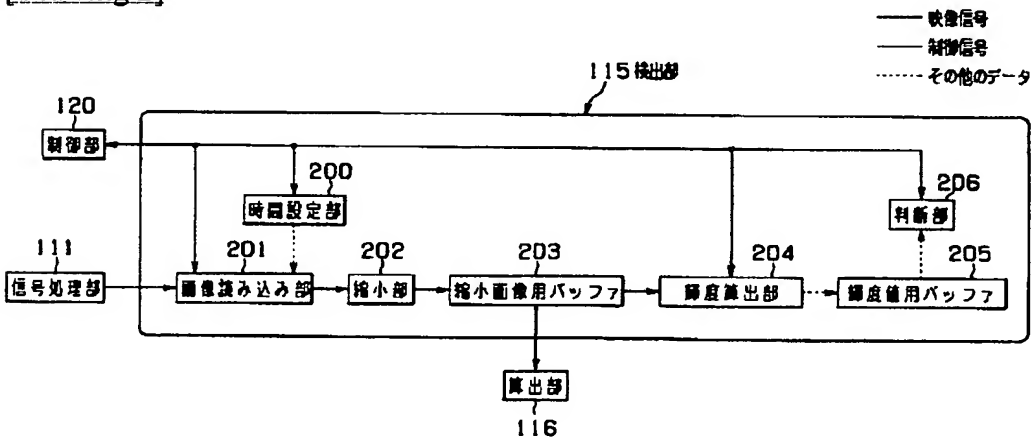
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

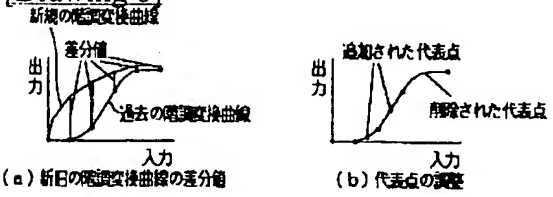
[Drawing 1]



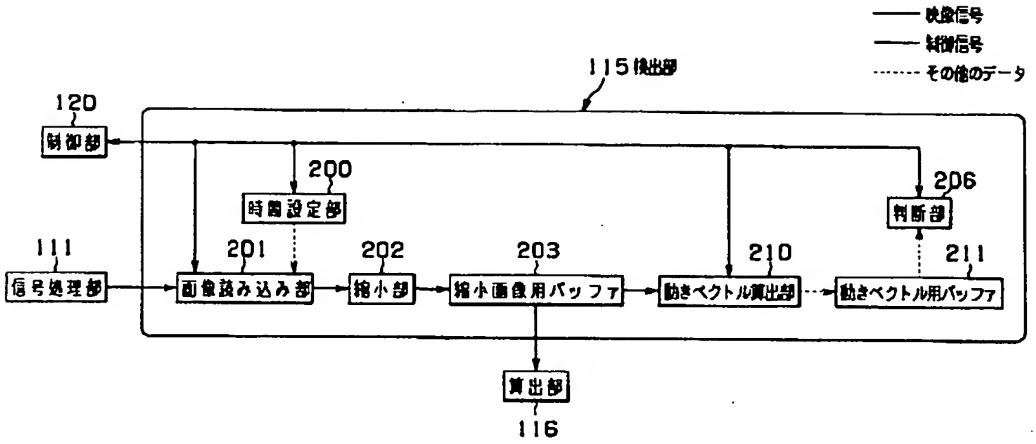
[Drawing 2]



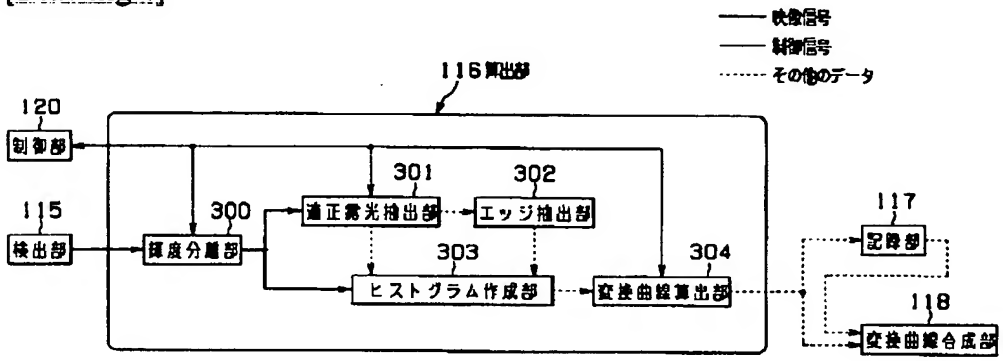
[Drawing 6]



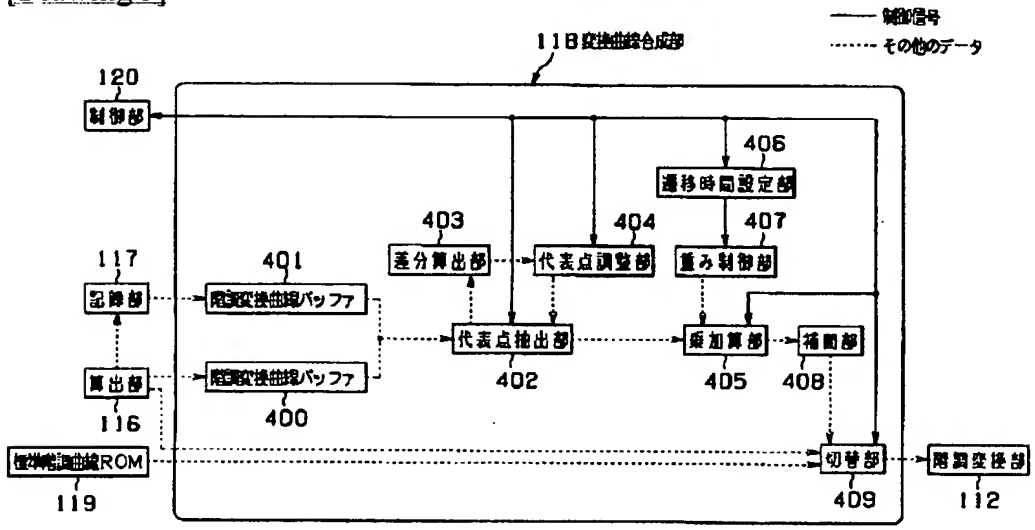
[Drawing 3]



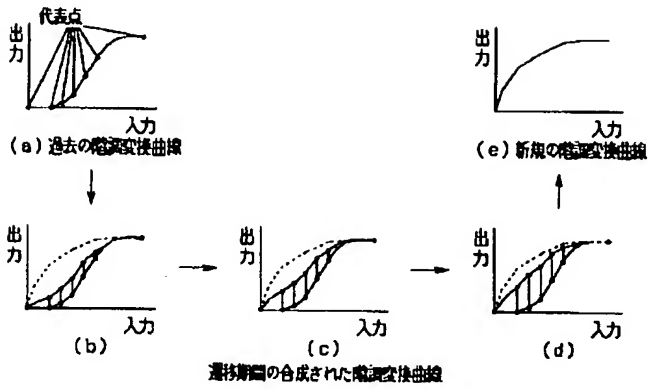
[Drawing 4]



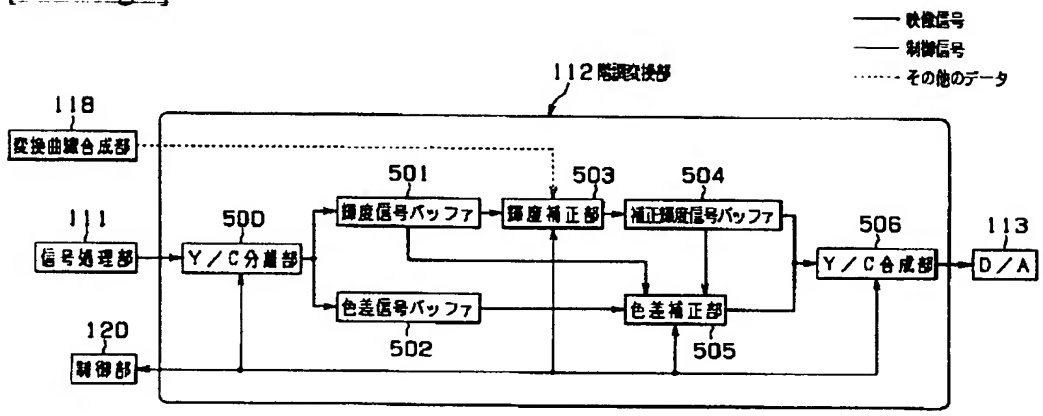
[Drawing 5]



[Drawing 7]



[Drawing 8]



[Translation done.]